Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_

**Must-Knows: Unit 4 (Cell Structure and Transport)**

Mrs. Krouse, AP Biology, 2016-2017

**Topic #1: Cell Structure and Function**

1. Identify the differences between a prokaryotic and a eukaryotic cell. Discuss the structures found in these cells, their relative size, and the types of organisms in which these cells are found.
2. Why is it an advantage for eukaryotic cells to have different compartments (aka organelles) in the cell (separated by membranes) with different environments (ex: different pH’s, different enzymes present, etc)?
3. Discuss the pathway that secretory proteins (proteins destined to leave the cell) take through the endomembrane system starting with their synthesis and ending with their secretion from the cell.
4. Cells with a large amount of Rough ER might be specialized for which function?

Cells with a large amount of Smooth ER might be specialized for which function?

Cells with many lysosomes might be specialized for which function?

Cells with many vacuoles might be specialized for which function?

Cells with many mitochondria might be specialized for which function?

Cells with many chloroplasts might be specialized for which function?

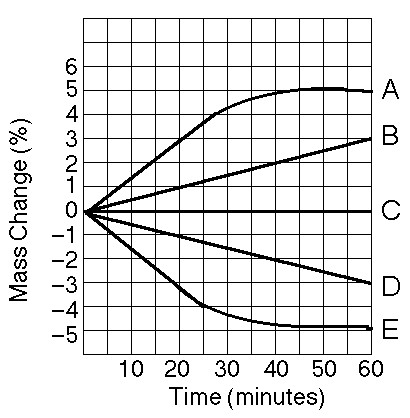
Cells with cilia and flagella might be specialized for which function?

Cells with many ribosomes might be specialized for which function?

Cells with cell walls but no other organelles (i.e. dead cells, like some found inside the trunks of trees) might be specialized for which function?

1. In what organelles are microtubule proteins used?
2. How are plasmodesmata in plant cells and gap junctions in animal cells similar? What are they used for? How are animal cell tight junctions and desmosomes (aka adhesion junctions) different?
3. Are proteins produced in free ribosomes (aka cytoplasmic ribosomes) used in the cell or sent out of the cell?
4. Where are proteins produced in bound / attached ribosomes (aka Rough ER ribosomes) used in the cell? What is an example of a protein produced in a bound ribosome?

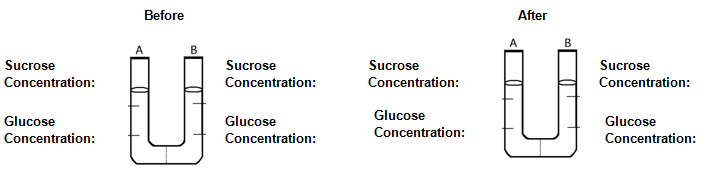
**Topic #2: Cell Membrane and Transport**

1. How do phospholipid molecules arrange themselves in the cell membrane? How does this give the cell membrane selective permeability (aka semipermeability)?
2. List three possible functions of membrane proteins.
3. What is the function of carbohydrate chains on the outside surface of the cell membrane?
4. How would increasing the amount of cholesterol molecules in between the phospholipids in the cell membrane affect the membrane’s flexibility?
5. How would increasing the amount of saturated phospholipid tails in the cell membrane affect the membrane’s flexibility? Explain your answer.
6. The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half-filled with a solution of 4 *M* sucrose and 3 *M* glucose. Side B is half-filled with 2 *M* sucrose and 5 *M* glucose. Initially, the liquid levels on both sides are equal.

After the system reaches equilibrium, what changes are observed in side A? (Circle the correct term that completes the statement)

* The concentration of sucrose **increases / decreases / stays the same**
* The concentration of glucose **increases / decreases / stays the same**
* In response to the movement of solutes, the water level **increases / decreases / stays the same**

You may want to draw a sketch (see images below) to indicate solute concentrations in the “U-Tube” before and after movement of solutes across the membrane. You may also want to draw an arrow on your “after” picture to indicate the direction of water movement.



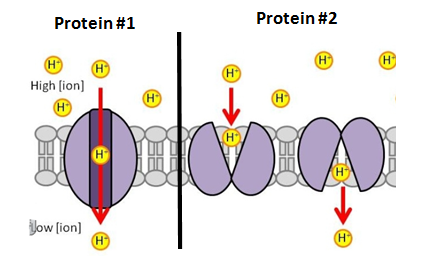
1. Five dialysis bags, constructed from a semipermeable membrane that is impermeable to sucrose, were filled with various concentrations of sucrose and then placed in separate beakers containing an initial concentration of 0.6 *M* sucrose solution. At 10-minute intervals, the bags were massed (weighed) and the percent change in mass of each bag was graphed.

* A positive percent change in the mass of the bag indicates that water has **entered / left** the bag.
* A negative percent change in the mass of the bag indicates that water has **entered / left** the bag.
* Bags A and B contain a solution that is **hypotonic / hypertonic / isotonic** to the outside solution
* Bag C contains a solution that is **hypotonic / hypertonic / isotonic** to the outside solution.
* Bags D and E contain a solution that is **hypotonic / hypertonic / isotonic** to the outside solution.
* Bag **A / E** has the highest initial concentration of sucrose.
* Bag **A / E** has the lowest initial concentration of sucrose.
* Bag **A / E** has the highest initial concentration of water.
* Bag **A / E** has the lowest initial concentration of water.

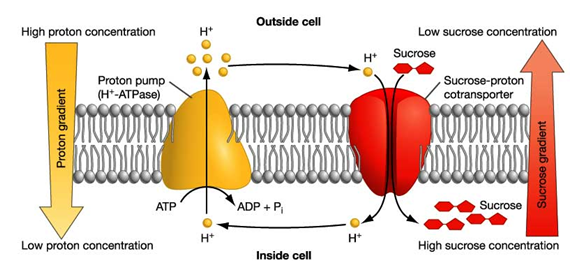
1. What kind of molecules pass through the cell membrane most easily? (small vs. large, nonpolar vs. polar or charged)
2. Complete each statement below with the term that describes the effect of water movement into and out of real plant and animal cells.

* When placed in hypotonic solution, a plant cell becomes **plasmolyzed / flaccid / turgid.**
* When placed in isotonic solution, a plant cell becomes **plasmolyzed / flaccid / turgid.**
* When placed in hypertonic solution, a plant cell becomes **plasmolyzed / flaccid / turgid.**
* When placed in hypotonic solution, an animal cell may **shrivel / lyse.**
* When placed in hypertonic solution, an animal cell may **shrivel / lyse.**

1. In the picture given below, identify the carrier protein and the channel protein. What type of membrane transport is shown in this image?



1. If the image above shows the movement of H+ into the cell, what direction will water move (into or out of the cell) and why?
2. Describe how sucrose is transported into the cell using the H+ / sucrose cotransporter. Use the image below to help you!



1. What is a symporter? How is it different from an antiporter?
2. Is the H+ / sucrose cotransport system involved in passive or active transport? How do you know?
3. Describe the difference between the three types of endocytosis—phagocytosis, pinocytosis, and receptor-mediated endocytosis. How is endocytosis different from exocytosis?

**Topic #3: Water Potential and Cell Size Calculations**

1. Which cells (smaller or larger cells) have higher surface area to volume ratios? How does this relate to the efficiency of transport across the membrane?
2. Plant cells have a large central vacuole. How does this affect the surface area to volume ratio of the cell? (Hint: See the Notes section on vacuoles)
3. If a cell’s ΨP = 2 bars and its ΨS = -6.5 bars, what is the resulting Ψ?
4. The cell from the question above is placed in a beaker of sugar water with ΨS = -3.0 bars.  In which direction will the net flow of water be?
5. The original cell from question # 26 is placed in a beaker of sugar water with ΨS = -0.25 MPa (megapascals).  We know that 1 MPa = 10 bars.  In which direction will the net flow of water be?
6. The value for Ψ in root tissue was found to be -4.4 bars.  If you take the root tissue and place it in a 0.2 M solution of sucrose at 25°C in an open beaker, what is the Ψ of the solution, and in which direction would the net flow of water be?